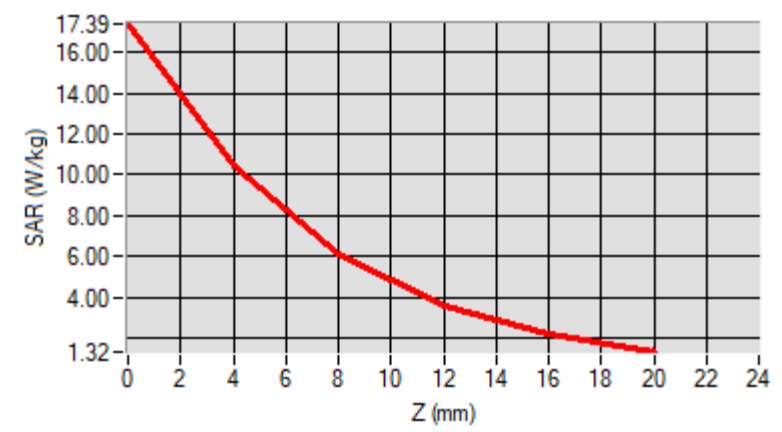
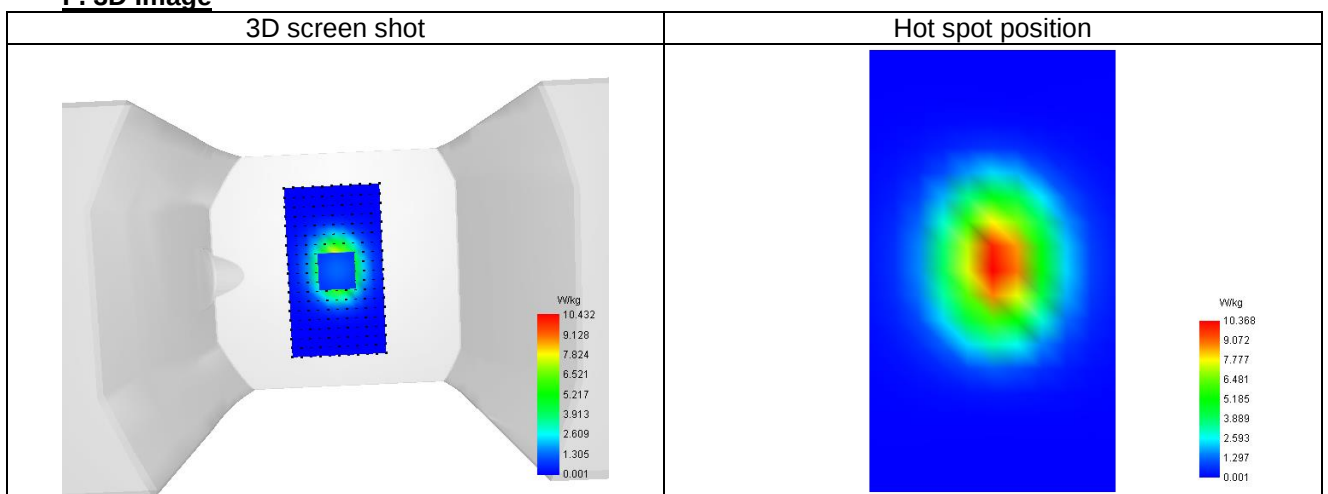




F. 3D Image



System check at 2450 MHz

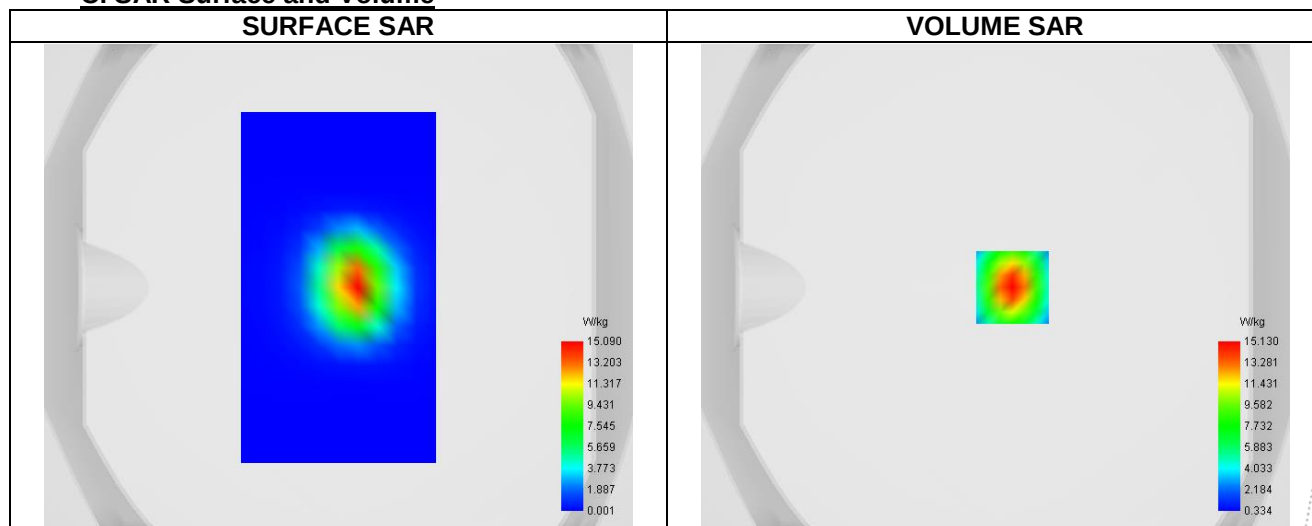
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.11
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=4mm
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2450.000
Relative permittivity (real part)	39.515
Relative permittivity (imaginary part)	13.242
Conductivity (S/m)	1.746

C. SAR Surface and Volume



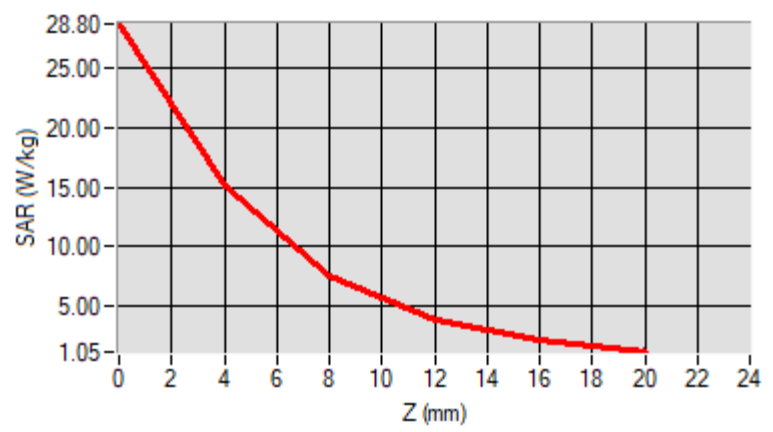
Maximum location: X=7.00, Y=0.00 ; SAR Peak: 29.42 W/kg

D. SAR 1g & 10g

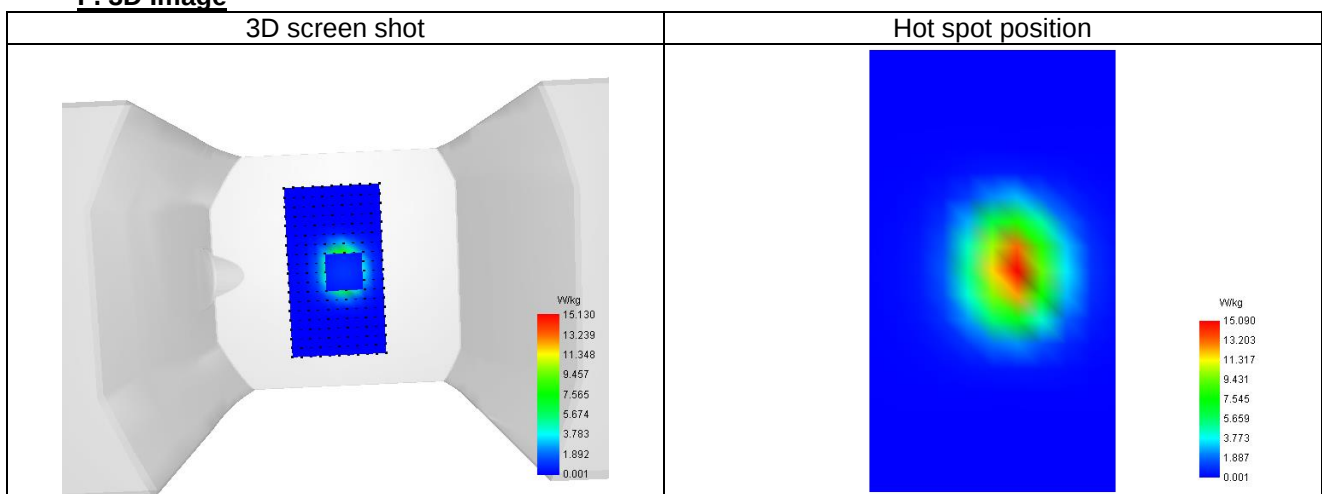
SAR 10g (W/Kg)	6.780
SAR 1g (W/Kg)	13.233
Variation (%)	-2.350
Horizontal validation criteria: minimum distance (mm)	-
Vertical validation criteria: SAR ratio M2/M1 (%)	-

E. Z Axis Scan

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	28.802	15.018	7.416	3.658	1.912



F. 3D Image



System check at 2600 MHz

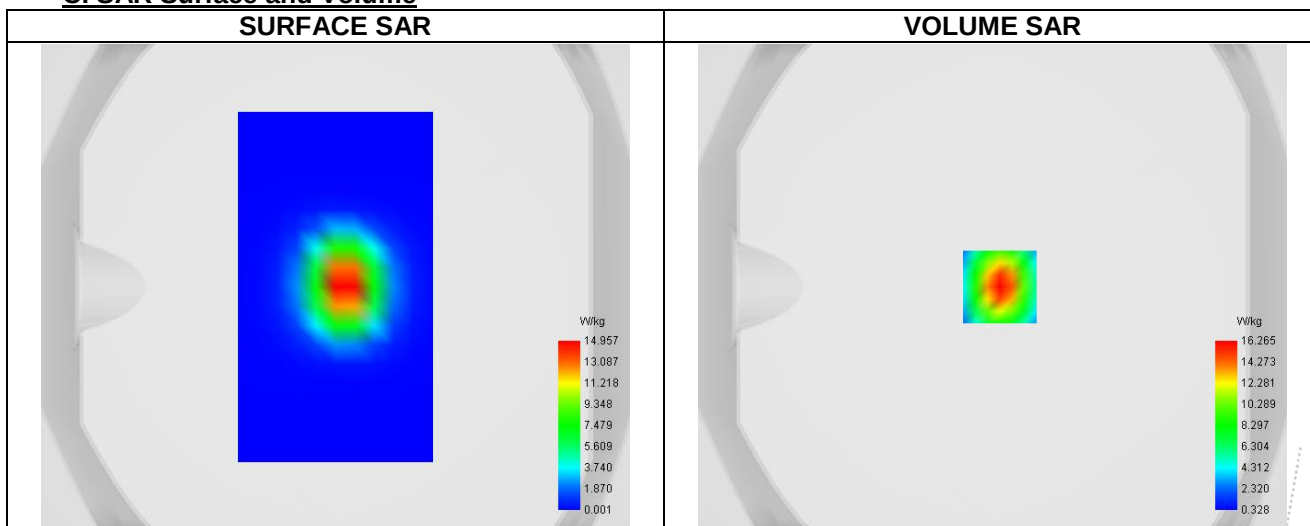
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.03
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=4mm
Phantom	Validation plane
Device Position	Dipole
Band	CW2600
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2600.000
Relative permittivity (real part)	40.469
Relative permittivity (imaginary part)	13.906
Conductivity (S/m)	2.036

C. SAR Surface and Volume



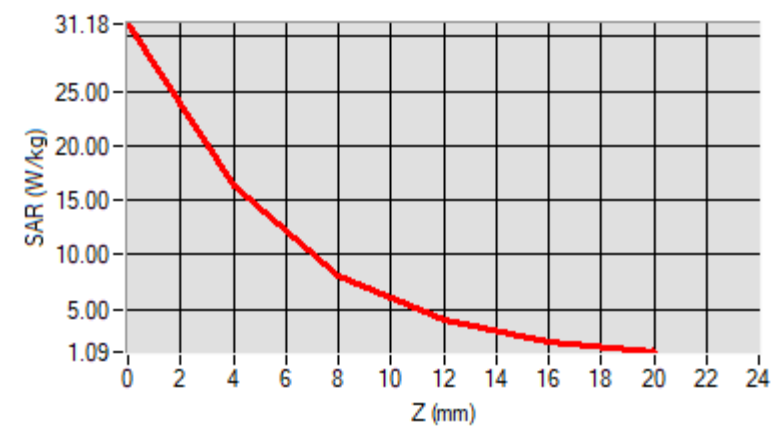
Maximum location: X=3.00, Y=0.00 ; SAR Peak: 31.98 W/kg

D. SAR 1g & 10g

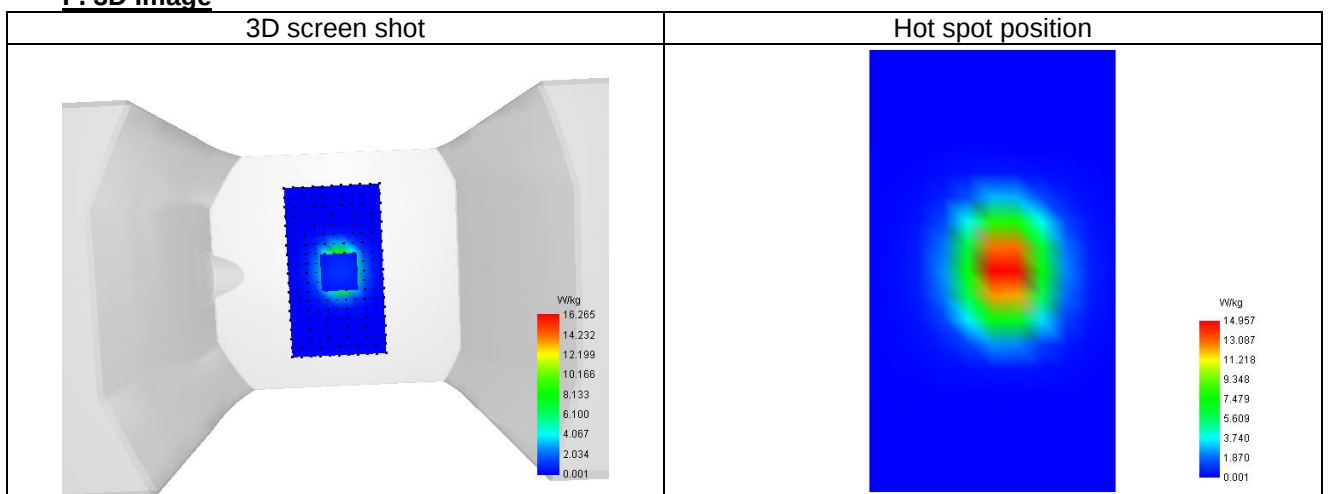
SAR 10g (W/Kg)	6.399
SAR 1g (W/Kg)	13.913
Variation (%)	2.273
Horizontal validation criteria: minimum distance (mm)	-
Vertical validation criteria: SAR ratio M2/M1 (%)	-

E. Z Axis Scan

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	31.172	16.108	7.982	3.835	1.964



F. 3D Image



15.2 SAR Test Graph Results

SAR plots for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination according to FCC KDB 865664 D02

Plot 1

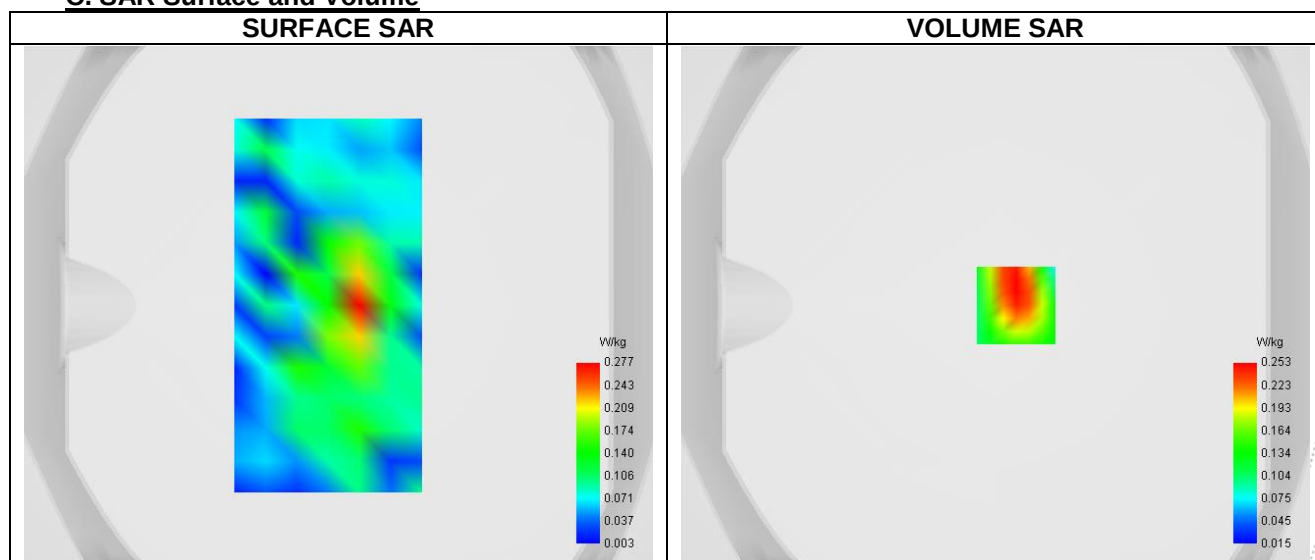
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	0.81
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	GSM850
Channels	Middle
Signal	Custom (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	836.600
Relative permittivity (real part)	40.822
Relative permittivity (imaginary part)	19.400
Conductivity (S/m)	0.865

C. SAR Surface and Volume



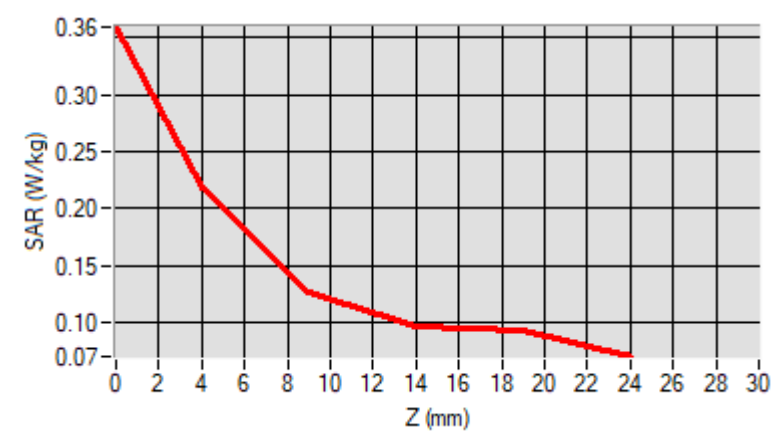
Maximum location: X=8.00, Y=0.00 ; SAR Peak: 0.38 W/kg

D. SAR 1g & 10g

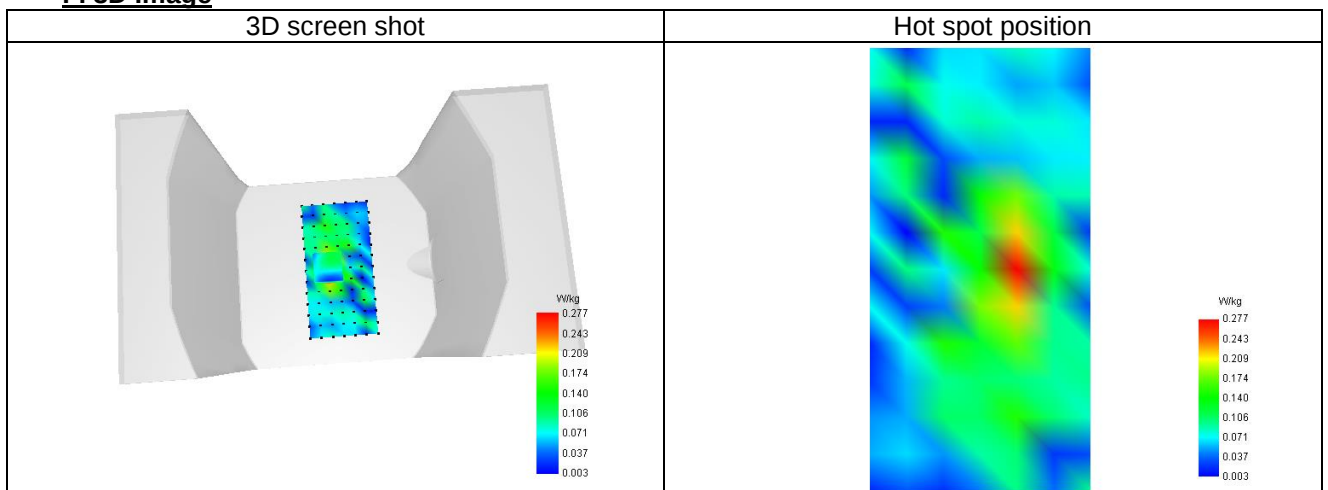
SAR 10g (W/Kg)	0.163
SAR 1g (W/Kg)	0.240
Variation (%)	3.830
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.273	0.253	0.170	0.124	0.122



F. 3D Image



Plot 2

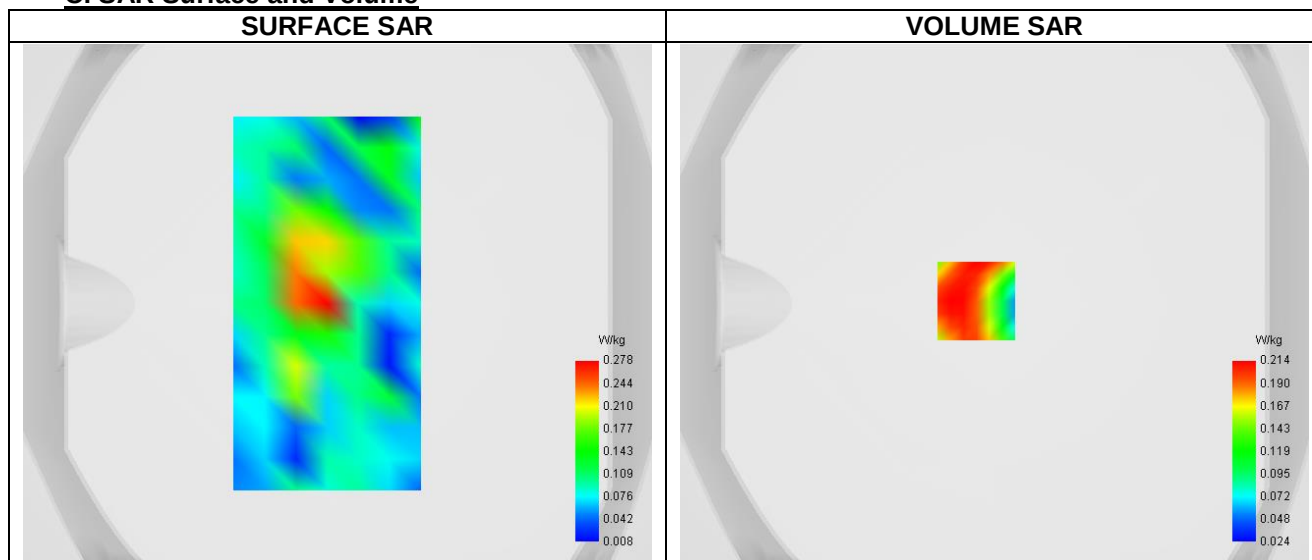
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.04
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	GSM1900
Channels	Middle
Signal	Custom (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1880.000
Relative permittivity (real part)	40.809
Relative permittivity (imaginary part)	13.408
Conductivity (S/m)	1.361

C. SAR Surface and Volume



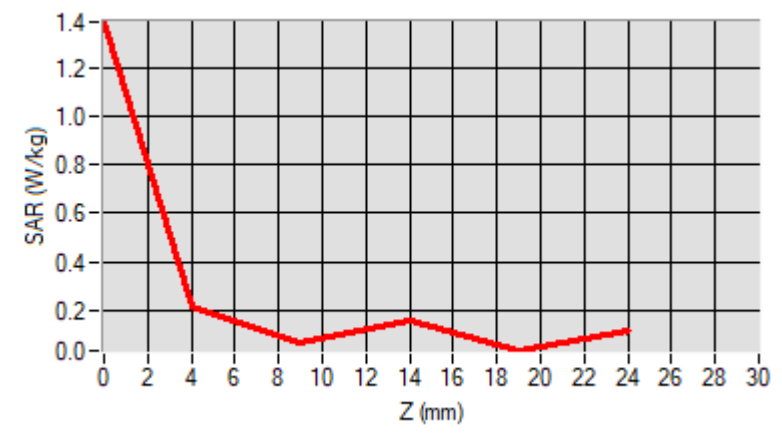
Maximum location: X=-7.00, Y=1.00 ; SAR Peak: 0.44 W/kg

D. SAR 1g & 10g

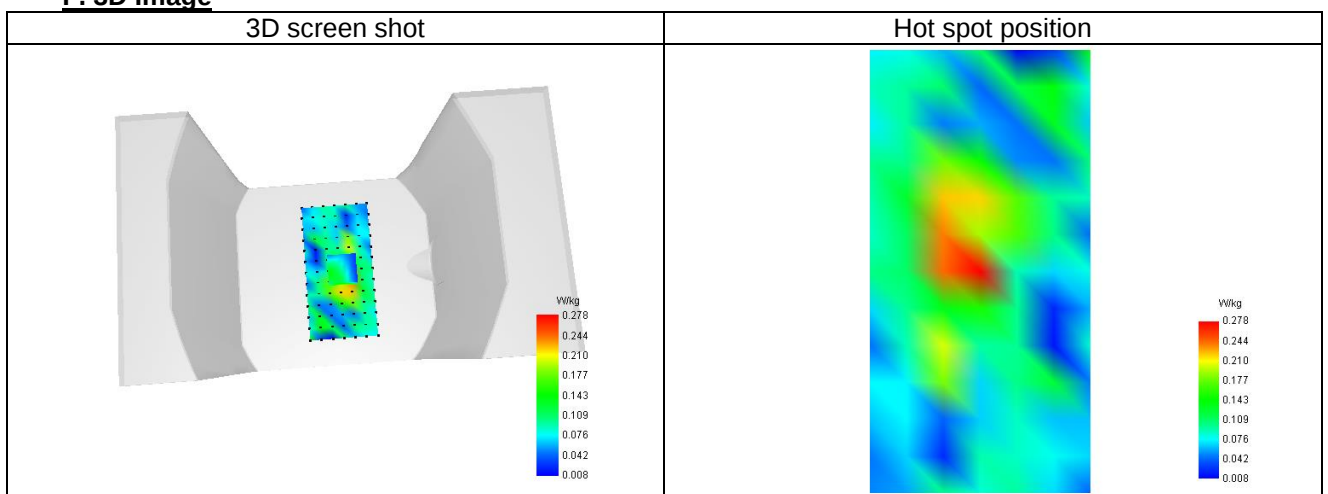
SAR 10g (W/Kg)	0.157
SAR 1g (W/Kg)	0.221
Variation (%)	3.300
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.389	0.214	0.063	0.157	0.032



F. 3D Image



Plot 3

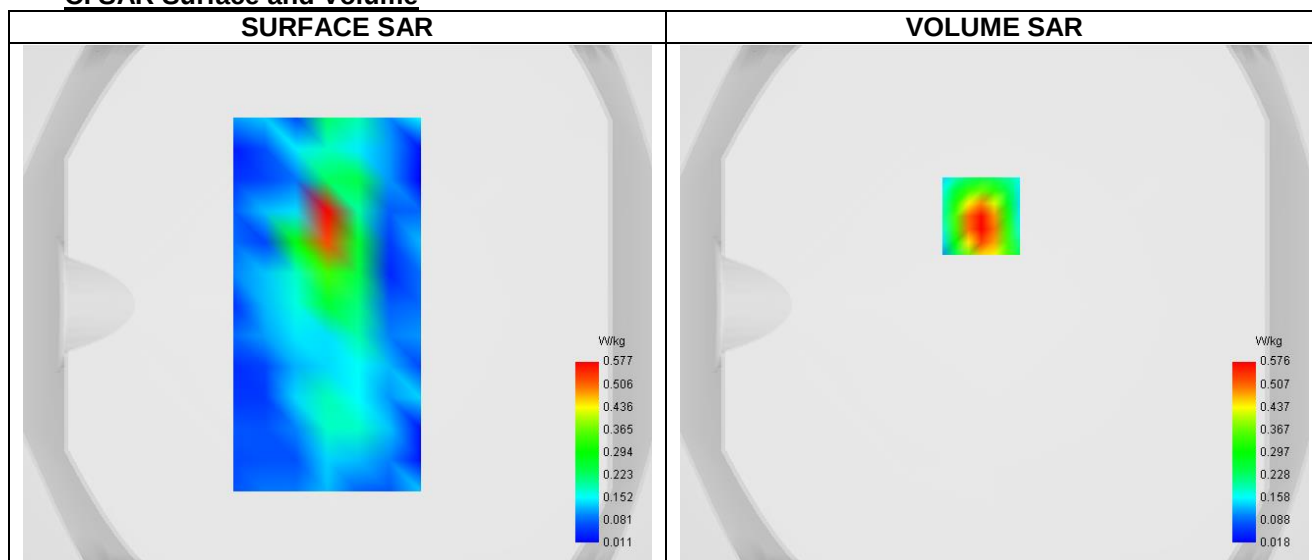
A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.04
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Band2_WCDMA1900
Channels	Middle (9400)
Signal	WCDMA (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1880.000
Relative permittivity (real part)	40.809
Relative permittivity (imaginary part)	13.408
Conductivity (S/m)	1.361

C. SAR Surface and Volume



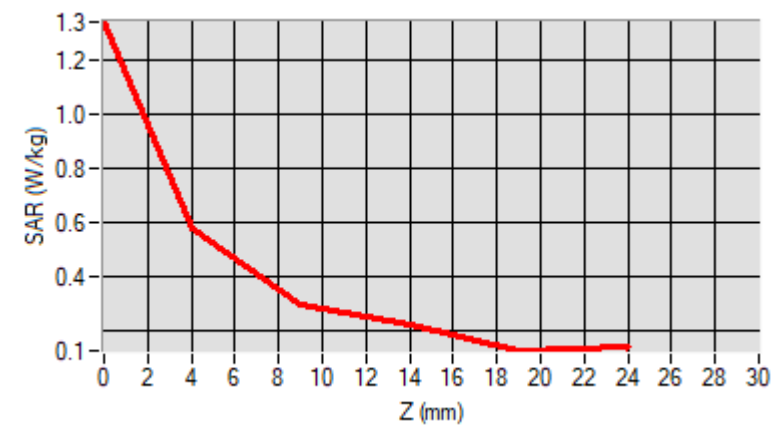
Maximum location: X=-5.00, Y=34.00 ; SAR Peak: 0.91 W/kg

D. SAR 1g & 10g

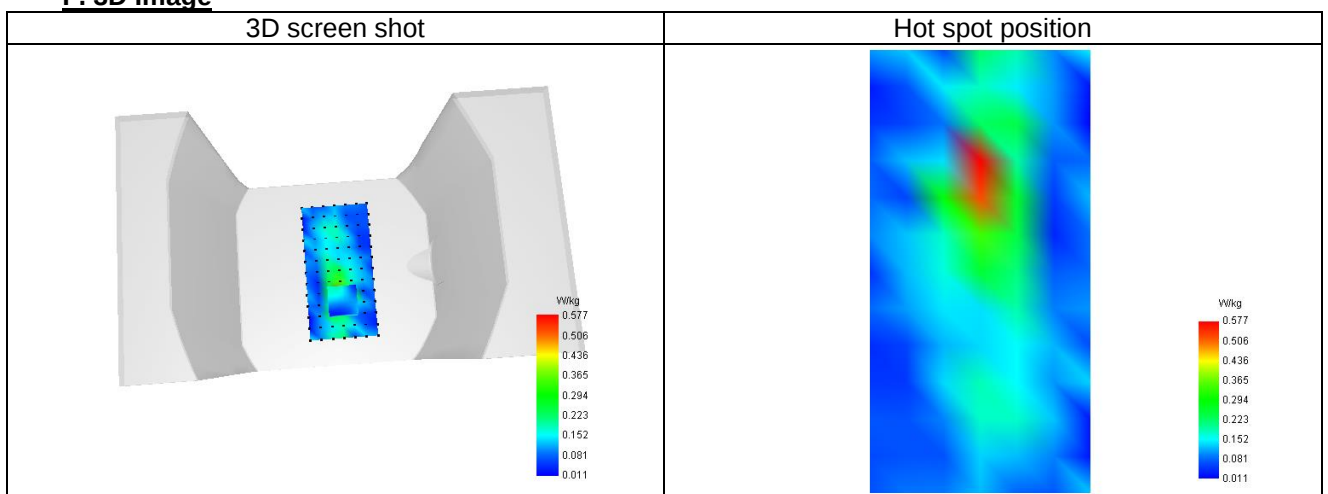
SAR 10g (W/Kg)	0.305
SAR 1g (W/Kg)	0.530
Variation (%)	-1.140
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.344	0.576	0.294	0.222	0.127



F. 3D Image



Plot 4

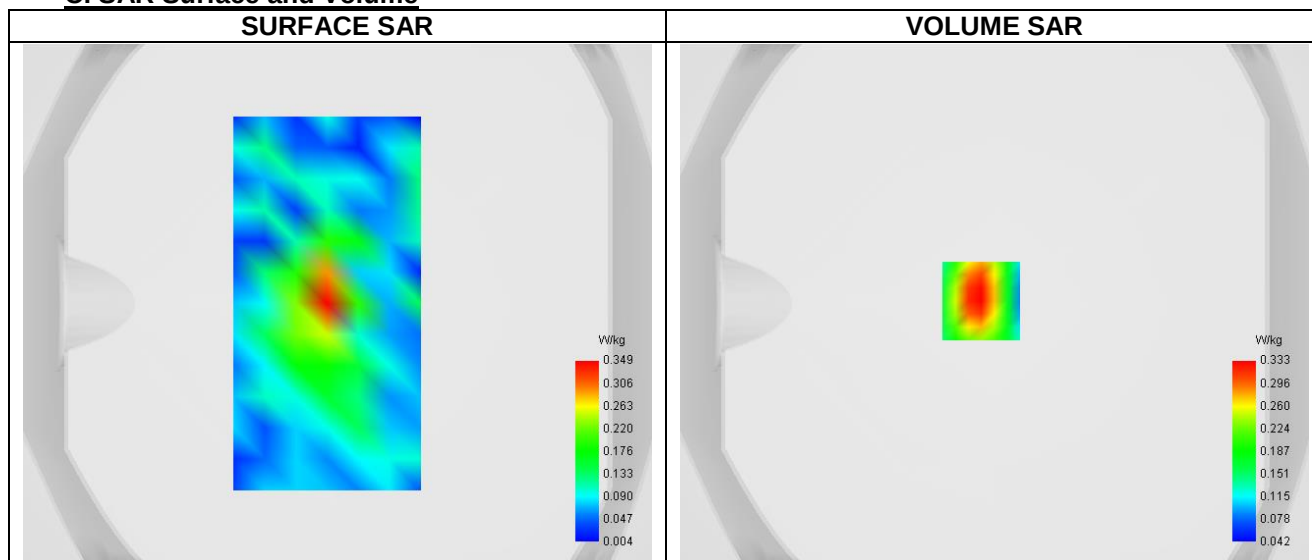
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	0.81
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Band5_WCDMA850
Channels	Middle (4182)
Signal	WCDMA (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	836.400
Relative permittivity (real part)	40.822
Relative permittivity (imaginary part)	20.226
Conductivity (S/m)	0.865

C. SAR Surface and Volume



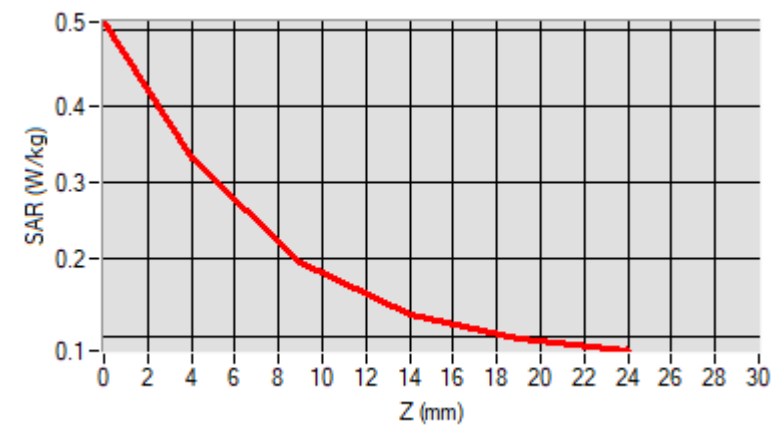
Maximum location: X=-5.00, Y=1.00 ; SAR Peak: 0.53 W/kg

D. SAR 1g & 10g

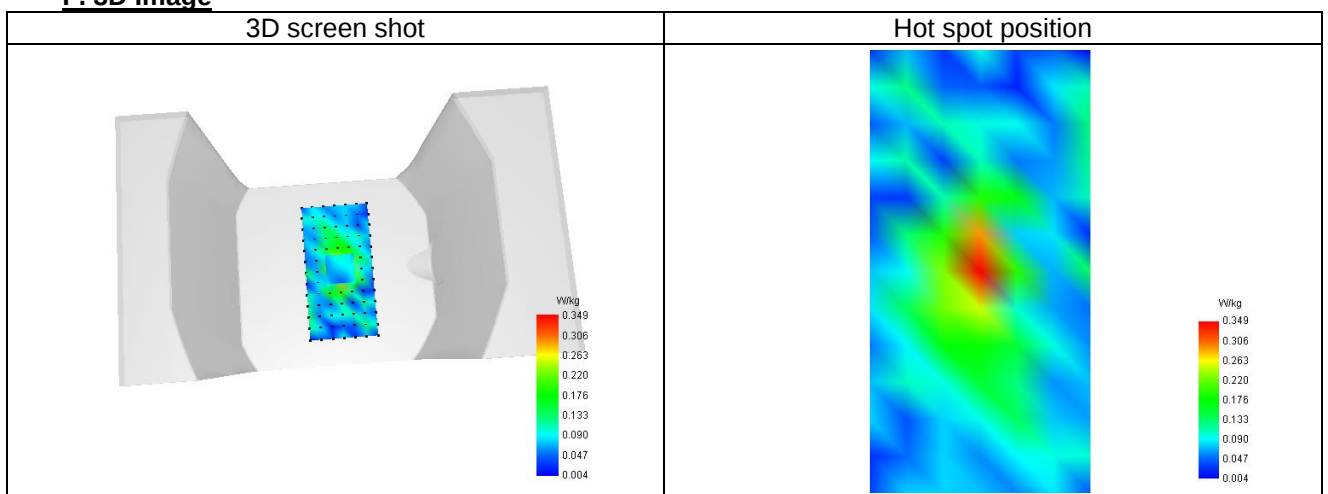
SAR 10g (W/Kg)	0.192
SAR 1g (W/Kg)	0.321
Variation (%)	-1.010
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.511	0.333	0.197	0.128	0.096



F. 3D Image



Plot 5

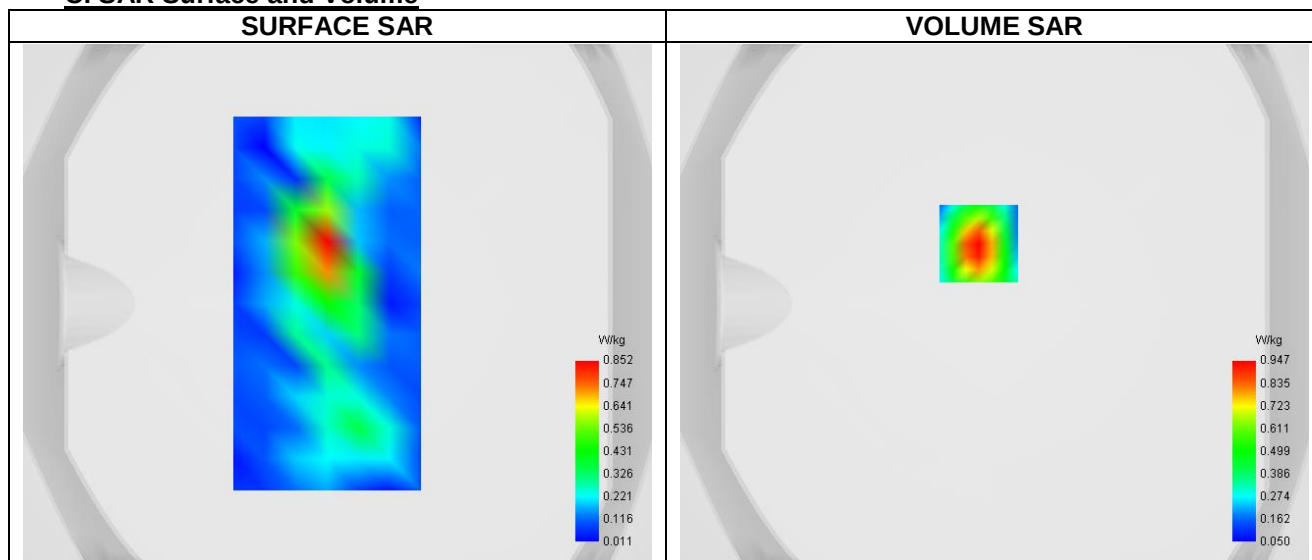
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.04
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	LTE band 2
Channels	Higher (19100)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1900.000
Relative permittivity (real part)	40.809
Relative permittivity (imaginary part)	13.260
Conductivity (S/m)	1.361

C. SAR Surface and Volume

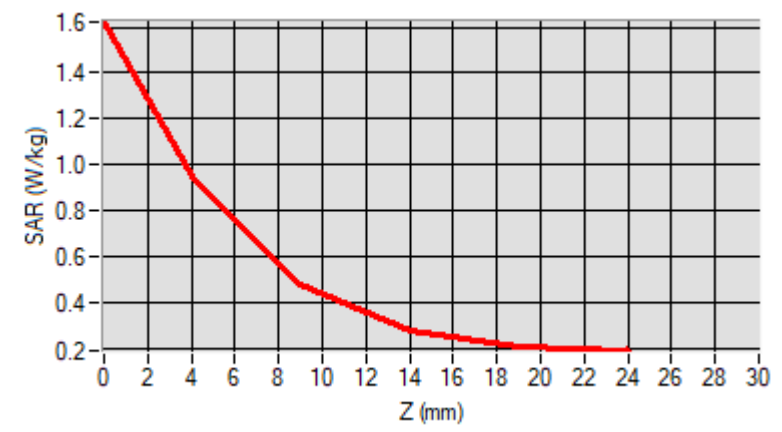


D. SAR 1g & 10g

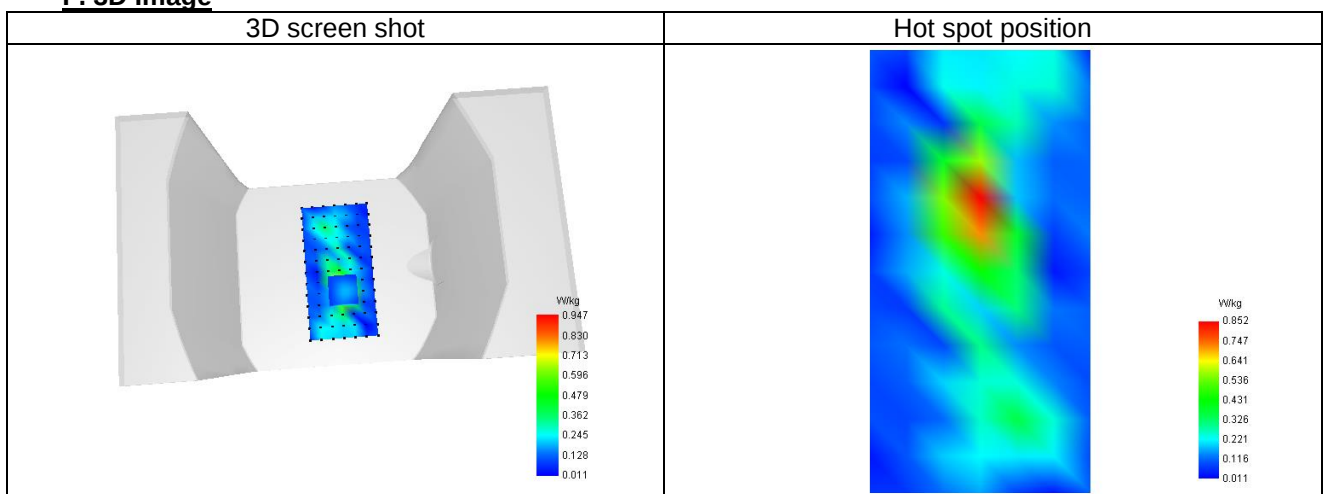
SAR 10g (W/Kg)	0.449
SAR 1g (W/Kg)	0.862
Variation (%)	0.040
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.622	0.947	0.481	0.278	0.210



F. 3D Image



Plot 6

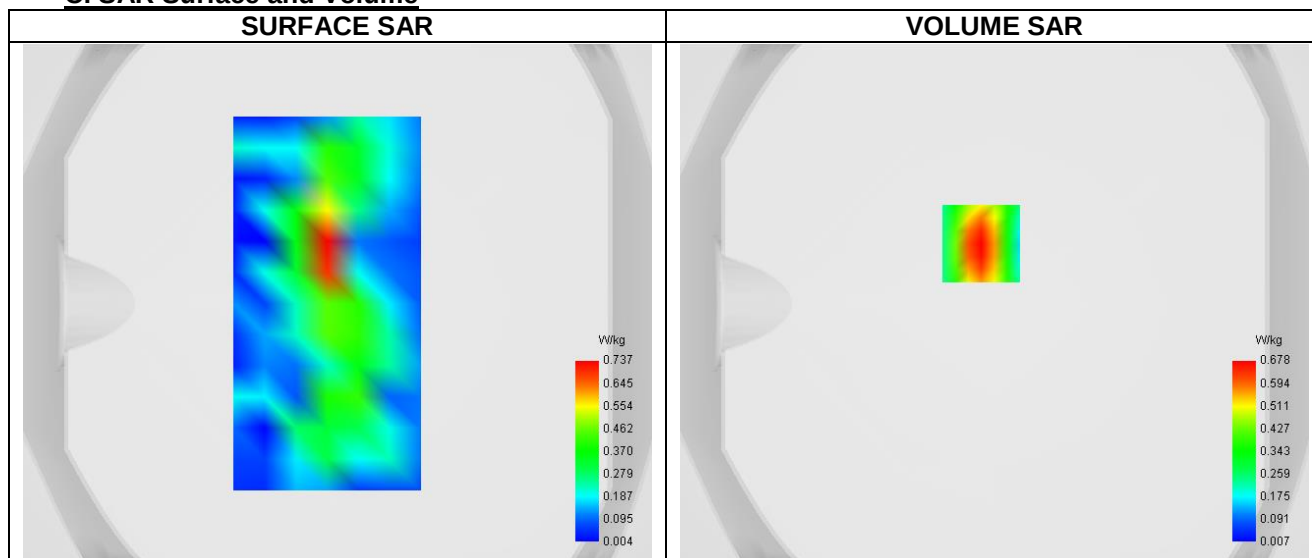
A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	0.96
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	LTE band 4
Channels	Lower (20050)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1720.000
Relative permittivity (real part)	39.641
Relative permittivity (imaginary part)	14.169
Conductivity (S/m)	1.436

C. SAR Surface and Volume



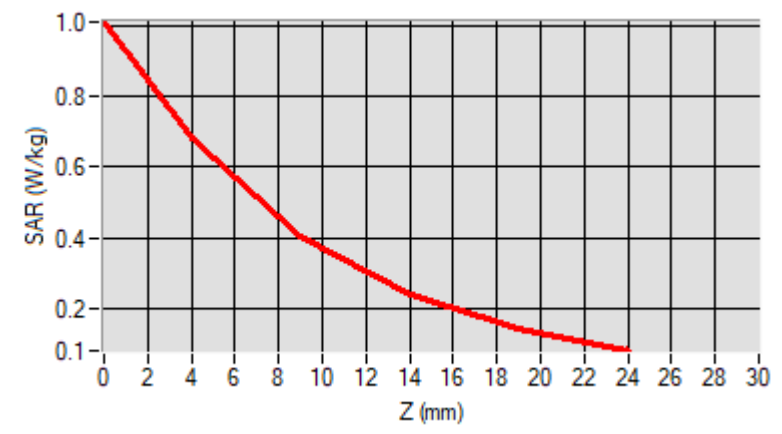
Maximum location: X=-5.00, Y=23.00 ; SAR Peak: 1.04 W/kg

D. SAR 1g & 10g

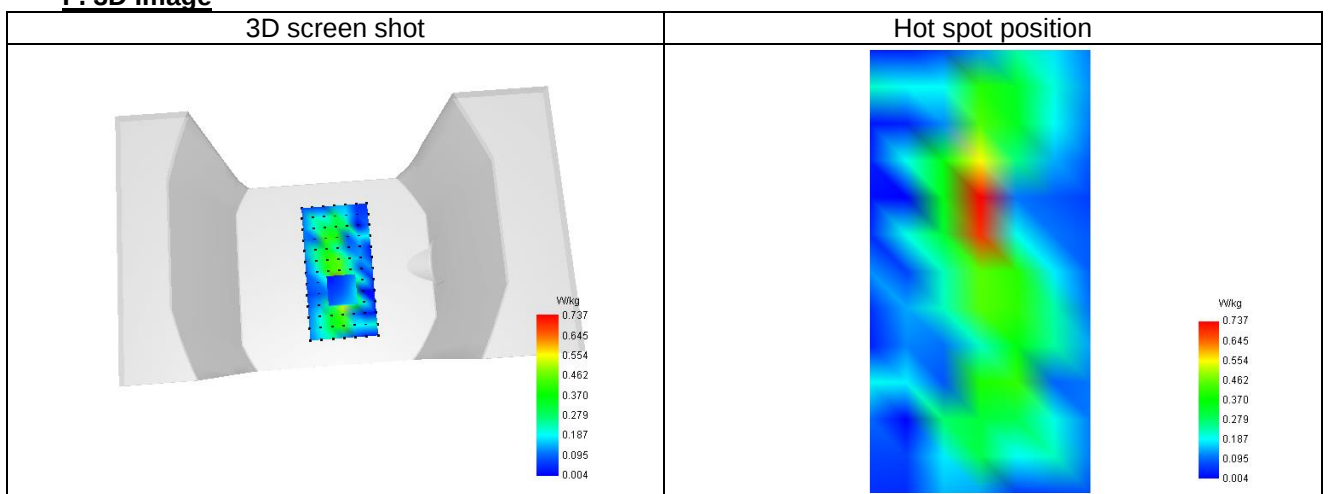
SAR 10g (W/Kg)	0.546
SAR 1g (W/Kg)	0.821
Variation (%)	-1.770
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.010	0.678	0.403	0.238	0.142



F. 3D Image



Plot 7

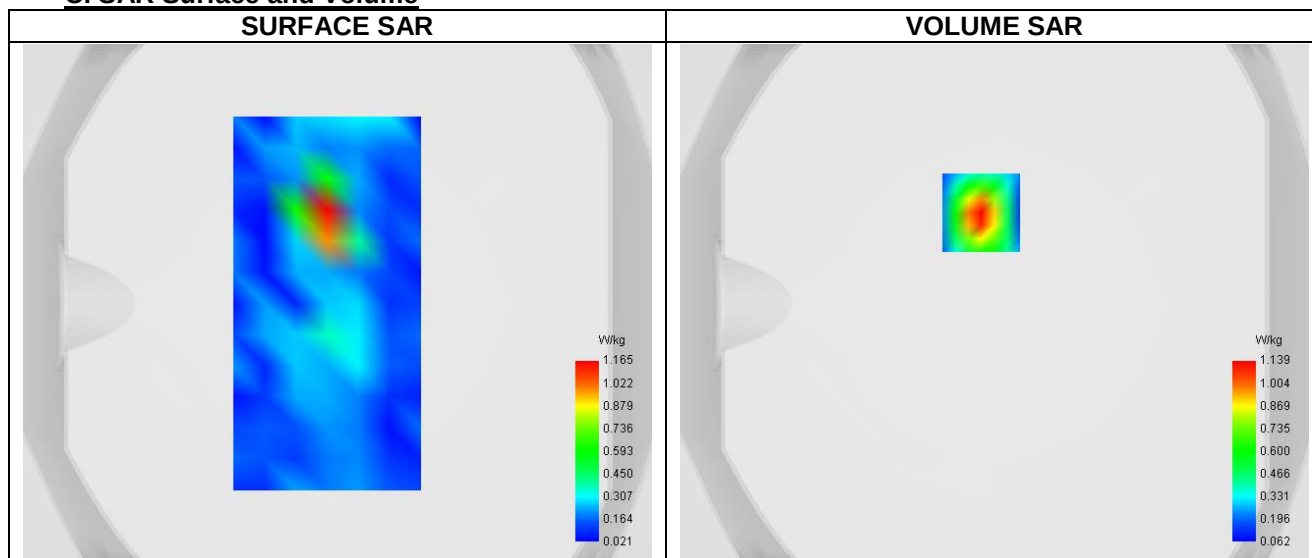
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.03
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	LTE band 7
Channels	Higher (21350)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2560.000
Relative permittivity (real part)	40.469
Relative permittivity (imaginary part)	13.477
Conductivity (S/m)	2.036

C. SAR Surface and Volume



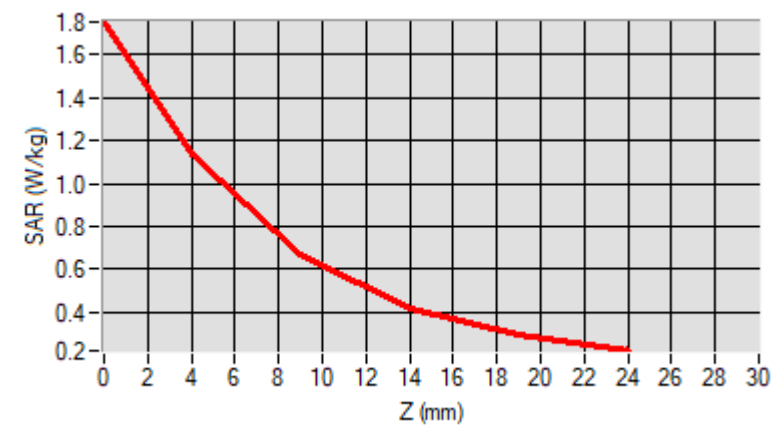
Maximum location: X=-5.00, Y=35.00 ; SAR Peak: 1.76 W/kg

D. SAR 1g & 10g

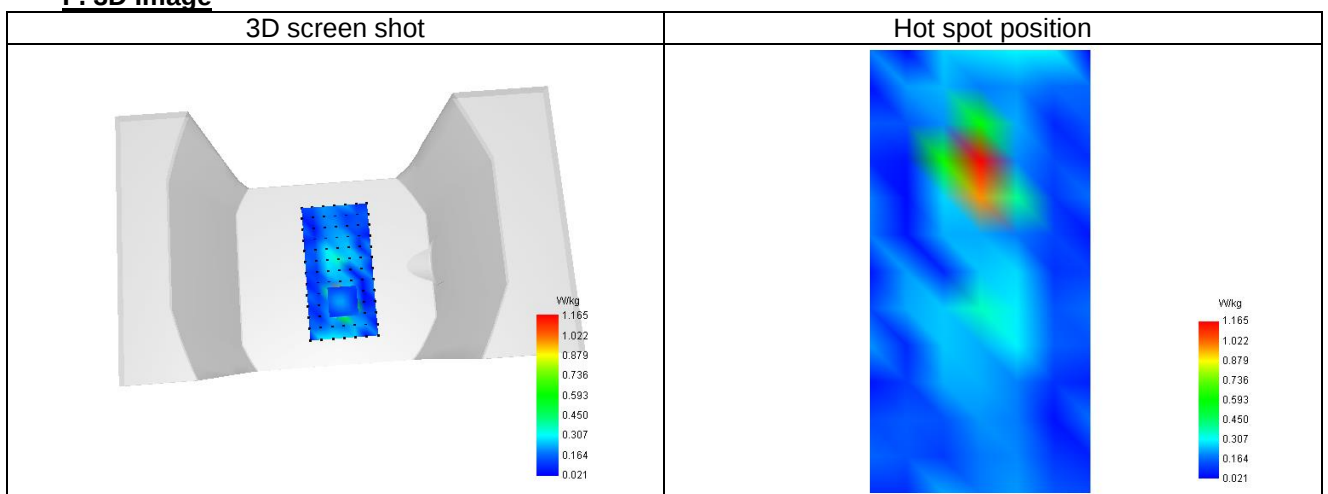
SAR 10g (W/Kg)	0.517
SAR 1g (W/Kg)	0.881
Variation (%)	1.010
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.751	1.139	0.666	0.415	0.292



F. 3D Image



Plot 8

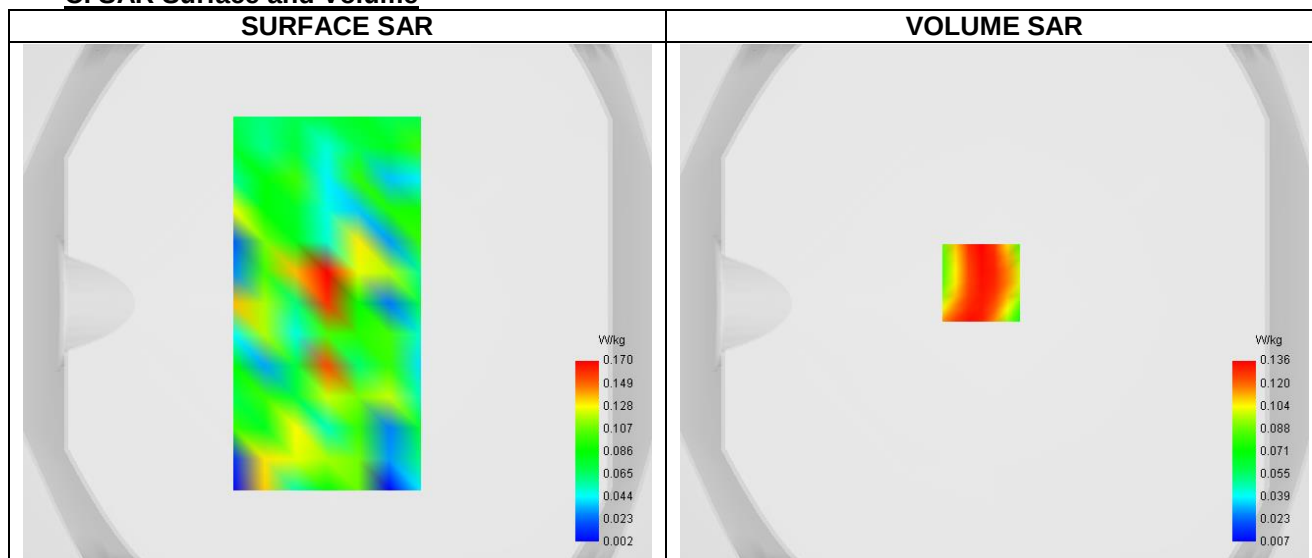
A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.11
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11b ISM
Channels	Middle (7)
Signal	IEEE802.b (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2442.000
Relative permittivity (real part)	39.515
Relative permittivity (imaginary part)	13.212
Conductivity (S/m)	1.746

C. SAR Surface and Volume

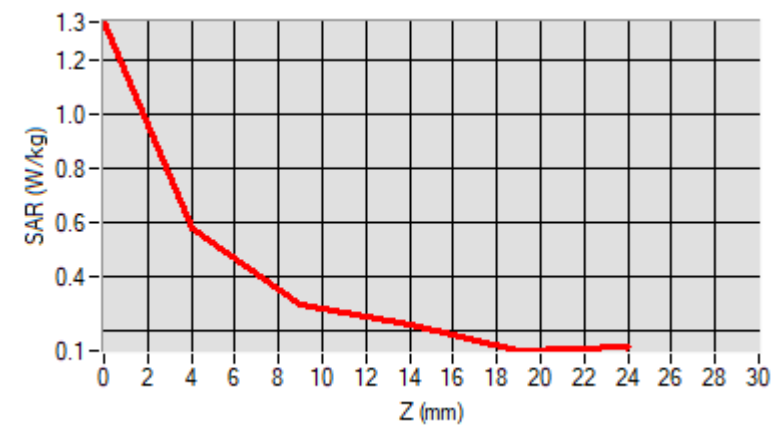


D. SAR 1g & 10g

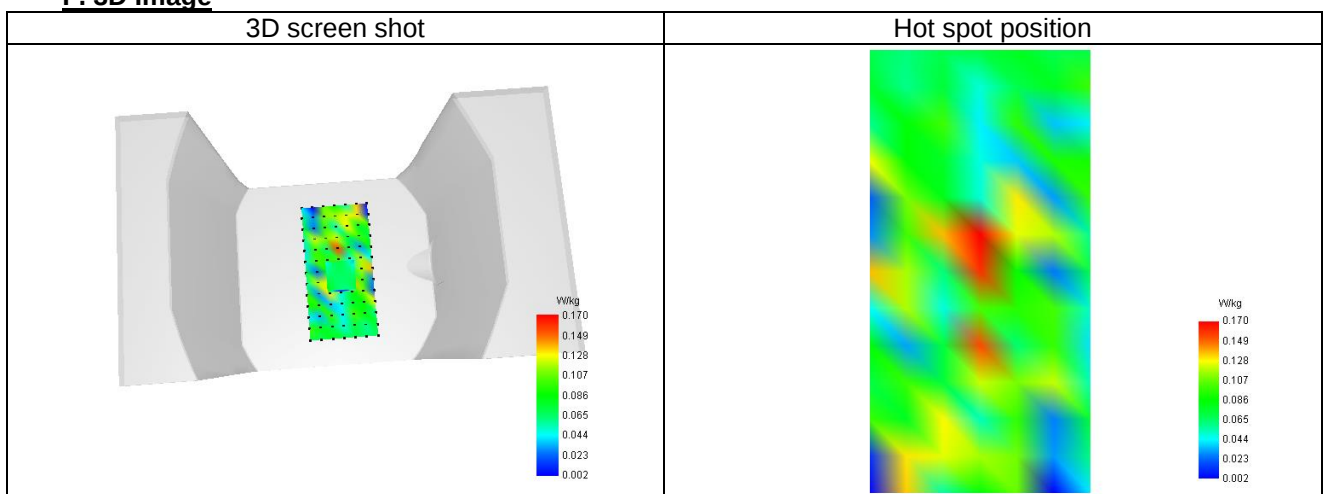
SAR 10g (W/Kg)	0.125
SAR 1g (W/Kg)	0.158
Variation (%)	3.920
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.047	0.219	0.073	0.036	0.170

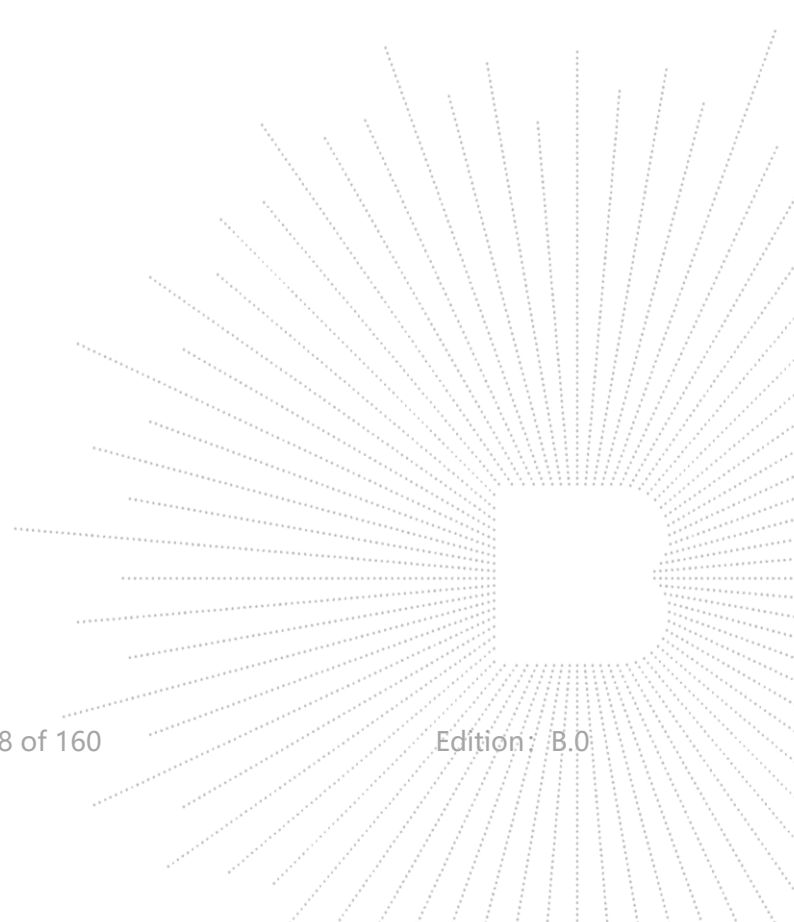


F. 3D Image



16. CALIBRATION CERTIFICATES

Probe-EPGO420 Calibration Certificate
SID835Dipole Calibration Certificate
SID1800Dipole Calibration Certificate
SID1900Dipole Calibration Certificate
SID2450Dipole Calibration Certificate
SID2600Dipole Calibration Certificate



**COMOSAR E-Field Probe Calibration Report**

Ref : ACR.199.1.23.BES.A

SHENZHEN BCTC TECHNOLOGY CO., LTD.

**1 ~2/ F, NO. B FACTORY BUILDING, PENGZHOU
INDUSTRIAL PARK, FUYUAN 1ST ROAD,
TANGWEI COMMUNITY, FUHAI STREET, BAO'AN
DISTRICT, SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: 2623-EPGO-420**

Calibrated at MVG**Z.I. de la pointe du diable**

**Technopôle Brest Iroise – 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE**

Calibration date: 7/18/2023

Accreditations #2-6789
Scope available on www.cofrac.fr

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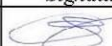
Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed at MVG, using the CALIPROBE test bench, for use with a MVG COMOSAR system only. The test results covered by accreditation are traceable to the International System of Units (SI).

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.199.1.23.BES.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Cyrille ONNEE	Measurement Responsible	7/18/2023	
<i>Checked & approved by:</i>	Jérôme Luc	Technical Manager	7/18/2023	
<i>Authorized by:</i>	Yann Toutain	Laboratory Director	7/18/2023	

Yann
Toutain ID

Signature numérique
de Yann Toutain ID
Date : 2023.07.18
10:38:49 +02'00'

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen BCTC Technology Co., Ltd.

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Cyrille ONNEE	7/18/2023	Initial release

Page: 2/11

Template_ACR.DDD.N.YY.MVGB.ISSUE_COMOSAR Probe vL

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1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	2623-EPGO-420
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-7.5GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.228 MΩ Dipole 2: R2=0.238 MΩ Dipole 3: R3=0.230 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards.



Figure 1 – MVG COMOSAR Dosimetric E field Probe

Probe Length	330 mm
Length of Individual Dipoles	24.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	2.55 mm
Distance between dipoles / probe extremity	12.7 mm

3 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their effect. All calibrations / measurements performed meet the fore-mentioned standards.

3.1 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards for frequency range 600-7500MHz and using the calorimeter cell method (transfer method) as outlined in the standards for frequency 150-450 MHz.



3.2 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

3.3 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 to 360 degrees in 15-degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.4 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

The boundary effect uncertainty can be estimated according to the following uncertainty approximation formula based on linear and exponential extrapolations between the surface and $d_{be} + d_{step}$ along lines that are approximately normal to the surface:

$$SAR_{uncertainty} [\%] = \delta SAR_{be} \frac{(d_{be} + d_{step})^2}{2d_{step}} \frac{(e^{-d_{be}/\delta} - e^{-d_{step}/\delta})}{\delta/2} \quad \text{for } (d_{be} + d_{step}) < 10 \text{ mm}$$

where

$SAR_{uncertainty}$	is the uncertainty in percent of the probe boundary effect
d_{be}	is the distance between the surface and the closest <i>zoom-scan</i> measurement point, in millimetre
Δ_{step}	is the separation distance between the first and second measurement points that are closest to the phantom surface, in millimetre, assuming the boundary effect at the second location is negligible
δ	is the minimum penetration depth in millimetres of the head tissue-equivalent liquids defined in this standard, i.e., $\delta \approx 14 \text{ mm}$ at 3 GHz;
ΔSAR_{be}	in percent of SAR is the deviation between the measured SAR value, at the distance d_{be} from the boundary, and the analytical SAR value.

The measured worst case boundary effect $SAR_{uncertainty}[\%]$ for scanning distances larger than 4mm is 1.0% Limit, 2%).



4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty associated with a SAR probe calibration using the waveguide or calorimetric cell technique depending on the frequency.

The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-11% for the frequency range 150-450MHz.

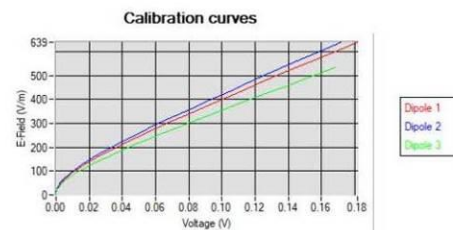
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

5 CALIBRATION RESULTS

Ambient condition	
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

5.1 CALIBRATION IN AIR

The following curve represents the measurement in waveguide of the voltage picked up by the probe toward the E-field generated inside the waveguide.



From this curve, the sensitivity in air is calculated using the below formula.

$$E^2 = \sum_{i=1}^3 \frac{V_i (1 + V_i / DCP_i)}{Norm_i}$$

where

Vi=voltage readings on the 3 channels of the probe

DCPi=diode compression point given below for the 3 channels of the probe

Normi=dipole sensitivity given below for the 3 channels of the probe